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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/866,576	05/29/2001	Tadahiro Ohmi	P 281355 EL01019CDC	4482

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EXAMINER

OWENS, DOUGLAS W

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 03/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/866,576

Applicant(s)

OHMI ET AL.

Examiner

Douglas W Owens

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 November 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-47 is/are pending in the application.
- 4a) Of the above claim(s) 9-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 40-47 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-5, 7, 8 and 40 – 44, 46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over US patent No. Ahn et al. in view of Campbell, The Science and Engineering of Microelectronic Fabrication, pages 29-31.

Regarding claim 1, 3, 40 and 42 Ahn et al. teaches a semiconductor device (Fig.

3) characterized by:

a silicon substrate (12);

a silicon oxide film (14) containing krypton (Col. 3, lines 10 – 16).

Ahn et al. inherently teach that the silicon oxide film is substantially defect free since the method of forming the silicon oxide film is the same as the method disclosed in the instant application.

Ahn et al. do not teach a silicon substrate comprising a (111) surface. Campbell teaches a silicon wafer formed from a boule and having a (111) surface (Figure 2-23). It would have been obvious to one of ordinary skill in the art to select a commercially available wafer with a (111) surface since it is commonly used in the art for p-type and n-type wafers and desirable for use because of its large surface density.

With respect to claim 40, Ahn et al. inherently teach that the silicon oxide film containing Kr reduces current leakage and improves breakdown characteristics of the insulation film when formed on a (111) surface since Ahn et al. teach a silicon oxide layer comprising the same material as that of the claimed invention. Additionally, Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). "[A]pparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Ahn et al. inherently teach a device wherein the krypton concentration decreases from a surface of the silicon oxide to an interface between the oxide and the crystal since Ahn et al. teach forming the silicon oxide by the same method as the claimed invention.

Regarding claims 2, 4, 41 and 43, Ahn et al. inherently teach a semiconductor device, wherein the silicon oxide film has a surface state density of $10^{11} \text{eV}^{-2} \text{cm}^{-2}$ or $5 \times 10^{11} \text{cm}^{-2}$ since the material and process is identical to that of the claimed invention.

Regarding claims 5 and 44, Ahn et al. teaches a semiconductor device further comprising a gate electrode (20) on the silicon oxide film.

Regarding claims 7 and 46, Ahn et al. do not teach a semiconductor device wherein the (111) crystal surface forms a principle part of the silicon substrate.

Campbell teaches a crystal surface that is the principle surface of a silicon substrate. It

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would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Ahn et al. for reasons discussed above.

Regarding claims 8 and 47, Ahn et al. do not teach a semiconductor device, wherein the (111) crystal surface is polysilicon. Campbell teaches a crystal surface comprising polysilicon (Figure 2-21). It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Jacobs et al. for reasons discussed above.

3. Claims 6 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn et al. in view of Campbell, pages 29-31 as applied to claim 1 above, and further in view of Campbell, pages 394-396.

Regarding claims 6 and 45, Ahn et al. do not teach a semiconductor device, wherein the crystal surface is part of a device isolation groove. Campbell teaches a trench isolation structure that is suitable for integrated circuits with high transistor densities. It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Campbell into the device taught by Jacob et al. since it is desirable to prevent unwanted shorting between active devices on a substrate. If the teaching of Campbell had been incorporated into the teaching of Ahn et al., the (111) surface would have been on a part of the device isolation groove (the bottom of the groove, for example).

Response to Arguments

4. Applicant's arguments filed November 26, 2003 have been fully considered but they are not persuasive.

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5. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the knowledge that it is desirable to form devices on wafers with a (111) surface because of the large surface density is generally available to one of ordinary skill in the art. It is further known and evidenced by Campbell that such wafers are in production and commercially available. Applicant concedes this on page 3 of the discussion of the prior art, where it is admitted that "...it is desirable to form a semiconductor device on a (111) surface of a Si crystal..." Applicant further states in the admitted prior art that forming high-quality dielectric films on a (111) surface at low temperatures is difficult at best. Ahn et al. discovered that by forming the gate oxide in high density krypton plasma, a high quality oxide can be formed **at low temperatures** (Col. 3, lines 10 – 16), which resolves the admitted prior art issue of forming high quality oxides at low temperatures.

Applicant argues that neither Ahn et al. nor Campbell teach an insulation film wherein the concentration of Kr decreases as in the oxide from a surface of the oxide to an interface with the crystal. Ahn et al. inherently teaches this feature since the process of forming the oxide is identical to that of the claimed invention. The Applicant further argues that the inherency assertion is based on improper hindsight reasoning. There is

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has been no suggestion to modify the teaching of Ahn et al. to construct the claimed invention. The assertion of hindsight reasoning when there has been no suggestion of reconstruction is not understood. The inherent teaching arises from the fact that the process is identical to that of the claimed invention. Although Ahn et al. does not mention this feature, it must be present because of the identical process steps.

Applicant argues that the inherent teaching of the Kr containing insulation film are based on improper hindsight reasoning. There has been no suggestion to modify the Kr containing insulation film. Additionally, claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). "[A]pparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Applicant argues that the gate layer (20) is not deposited on the gate insulation layer, but on the ferroelectric layer. It is clearly shown in Figs. 2 and 3 of Ahn et al. that the gate layer is deposited on the gate insulation layer, albeit, there are intervening layers, but the gate is nonetheless on the gate insulation layer.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 571-272-1662. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DWO



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